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APPLICATION NUMBER: *60/393,595*
FILING DATE: *July 03, 2002*
RELATED PCT APPLICATION NUMBER: *PCT/US03/21194*

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

M. Sias

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Certifying Officer

07/03/02 Jc759 U.S. PTO

60/393595 .070302 A1PRO

Practitioner's Docket No. 100325.0194PRO

PATENT

Jc879 U.S. PTO 60/393595

Preliminary Classification Proposed Class: Subclass:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Reddy, Satish; Scherffius, Jeffrey and Gilmartin, John

For: Improved Split Flow Process and Apparatus

Box Provisional Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

COVER SHEET FOR FILING PROVISIONAL APPLICATION
(37 C.F.R. § 1.51(c)(1))

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 C.F.R. § 1.51(c)(1)(i). The following comprises the information required by 37 C.F.R. § 1.51(c)(1):

1. The following comprises the information required by 37 C.F.R.§ 1.51(c)(1):

2. The names of the inventors are (37 C.F.R. § 1.51(c)(1)(ii)):

   1. Satish Reddy
   2. Jeffrey Scherffius
   3. John Gilmartin

EXPRESS MAILING UNDER 37 C.F.R. § 1.10*
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I hereby certify that this paper, along with any document referred to, is being deposited with the United States Postal Service on this date July 3, 2002 in an envelope addressed to the Assistant Commissioner for Patents, Washington D C. 20231 as "Express Mail Post Office to Addressee" Mailing Label No. EV062683185US.

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3. Residence addresses of the inventors, as numbered above (37 C.F.R. § 1.51(c)(1)(iii)):

   1. 7 Falling Leaf - Irvine, CA 92708

   2. 1 Kara Ct., Aliso Viejo, CA 92656

   3. 22501 Chase, # 5216, Aliso Viejo, CA 92656

4. The title of the invention is (37 C.F.R. § 1.51(c)(1)(iv)):

   Improved Split Flow Process and Apparatus

5. The name, registration, customer and telephone numbers of the practitioner are (37 C.F.R. § 1.51(c)(1)(v)):

   Name of practitioner: Martin Fessenmaier
   Reg. No. 46697
   Tel. 714-641-5100
   Customer No. 24392

6. The docket number used to identify this application is (37 C.F.R. § 1.51(c)(1)(vi)):

   Docket No. 100325.0194PRO

7. The correspondence address for this application is (37 C.F.R. § 1.51(c)(1)(vii)):

   Martin Fessenmaier
   Rutan & Tucker, LLP
   611 Anton Blvd., 14th Floor
   P.O. Box 1950
   Costa Mesa, CA 92626
   USA

8. Statement as to whether invention was made by an agency of the U.S. Government or under contract with an agency of the U.S. Government. (37 C.F.R. § 1.51(c)(1)(viii)).

This invention was NOT made by an agency of the United States Government, or under contract with an agency of the United States Government.

9. Identification of documents accompanying this cover sheet:

   A. Documents required by 37 C.F.R. § 1.51(c)(2)-(3):

Specification:	No. of pages	3
Drawings:	No. of sheets	3

10. Fee

The filing fee for this provisional application, as set in 37 C.F.R. § 1.16(k), is $80.00 for other than a small entity.

11. Fee payment

Fee payment in the amount of $80.00 is being made at this time.

12. Method of fee payment

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Date: 7/3/02

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Provisional Patent
Docket No.: 100325.0194PRO

DISCLOSURE

Title

Improved Split Flow Process and Apparatus

Description

The present invention is directed to a recovery plant that recovers a gaseous component from a process gas. Contemplated plants will typically have an absorber that employs a lean solvent and a semi-lean solvent, both of which absorb a gaseous component from the process gas, thereby producing a rich solvent and a lean process gas. Typical process gases include gases comprising carbon dioxide, and especially flue gases, while typical solvents include aqueous solvents (*e.g.*, amine based solvents). Moreover, it should be appreciated that the absorber in contemplated configurations operates at a pressure that is lower than the pressure in the regenerator(s). General configurations for the herein described improvements are disclosed in pending U.S. Pat. Application with the serial number 09/831,582, which is incorporated by reference herein.

In a particularly preferred configuration, two regenerators are fluidly coupled to an absorber, wherein both regenerators extract the gaseous component from a rich solvent, thereby regenerating a lean solvent in one of the two regenerators and a semi-lean solvent in the other one of the two regenerators. It should be especially appreciated that in such configurations the vapors of the lean regenerator and the semi-lean regenerator will typically not combine in the semi-lean regenerator as is the case in various currently known configurations. Consequently, the carbon dioxide partial pressure is lowered in the semi-lean regenerator, which significantly improves process efficiency. The lean solvent and the semi-lean solvent are preferably cooled against the rich solvent, thereby preheating the rich solvent streams before entering the lean solvent regenerator (first regenerator) and the semi-lean regenerator (second regenerator). The lean and semi-lean solvents may be further cooled in additional coolers prior to entering the absorber. Various modifications of such configurations may be employed, and especially advantageous configurations are as contemplated below.

In one configuration, as depicted in **Figure 1**, the rich gas leaving the lean and semi-lean regenerators is cooled in separate condensers or a common condenser, with at least a portion of the reflux liquid returning to the top of the lean solvent regenerator. However, the rich gaseous stream leaving the top of the lean solvent regenerator is not routed into the semi-lean solvent regenerator. Consequently, the partial pressure of the gaseous component in the semi-lean regenerator remains relatively low.

In another configuration, as depicted in **Figure 2**, steam is used to provide reboiler energy to the lean-solvent regenerator. The steam is condensed in the reboiler, producing a saturated condensate. All or a portion of this condensate is then let-down in pressure across a pressure reducing device to the pressure of the semi-lean regenerator, resulting in a partial flashing of the condensate stream into a new low-pressure steam, which is then fed to the semi-lean regenerator. Using the low pressure steam in the semi-lean regenerator advantageously enables a lower semi-lean loading by lowering the partial pressure of the gaseous component in the semi-lean regenerator and by adding heat to the semi-lean regenerator.

In yet another configuration, as depicted in **Figure 3**, a recovery plant is thermally integrated with a power.plant that supplies the process gas feed to the absorber, wherein one or more power plant streams may be used to pick up heat from the recovery plant process, thereby increasing the overall thermal efficiency of the combined facilities. Particularly preferred plant configurations according to Figure 3 include combined facilities with an acid gas removal plant due to increased significance of efficient removal of greenhouse gases (and especially carbon dioxide) from off gases from power plants. Numerous sources of heat in the recovery plant are contemplated. For example, a vacuum condensate stream from a steam turbine condenser in a power plant can pick up heat from the lean and semi-lean regenerator overhead gas streams, thereby providing at least a portion of the cooling required for the regenerator condenser service. In another example, heat can be taken from the lean and semi-lean streams before they enter the absorber. Furthermore, heat can be extracted from the absorber column, especially towards the bottom of the absorber where the solvent is hottest. Such configurations are thought to improve mass transfer and may thereby reduce column size of the absorber.

Similarly, the power plant may provide heat to the recovery plant. The heat is required in the recovery plant for regeneration of solvent. For example, heat may be added to the rich solvent stream prior to entering the lean or semi-lean regenerator, or heat may be added to the lean or semi-lean regenerator. Numerous sources of heat in the power plant are contemplated. These sources of heat include, but are not limited to, a coil in a heat recovery steam generator or flash steam from a boiler feed water blowdown drum.

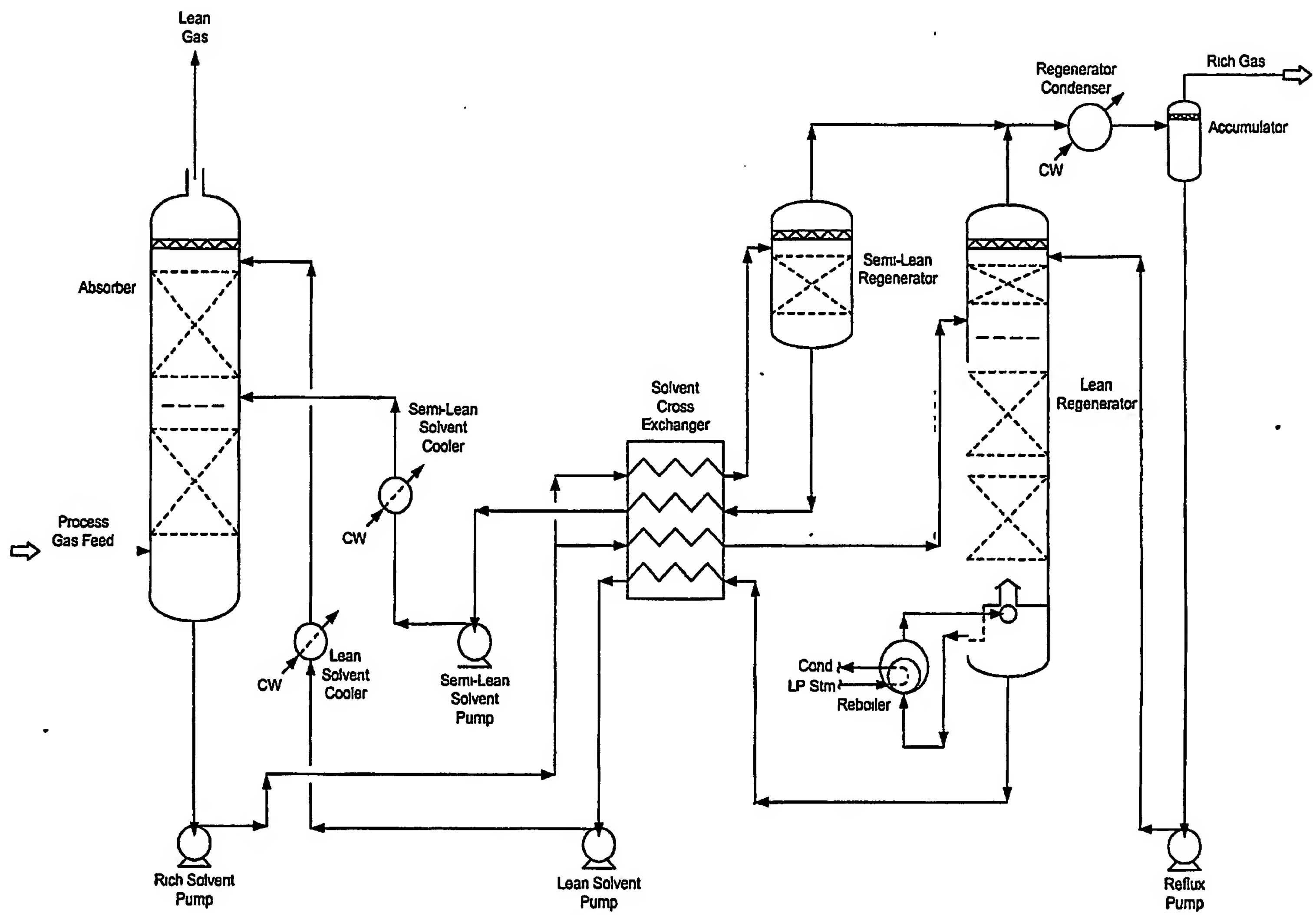
Lean Gas
Absorber
Process Gas Feed
CW
Lean Solvent Cooler
Semi-Lean Solvent Cooler
CW
Rich Solvent Pump
Semi-Lean Solvent Pump
Lean Solvent Pump
Solvent Cross Exchanger
Semi-Lean Regenerator
Lean Regenerator
Regenerator Condenser
CW
Rich Gas
Accumulator
Cond
LP Stm
Reboiler
Reflux Pump

Figure 1

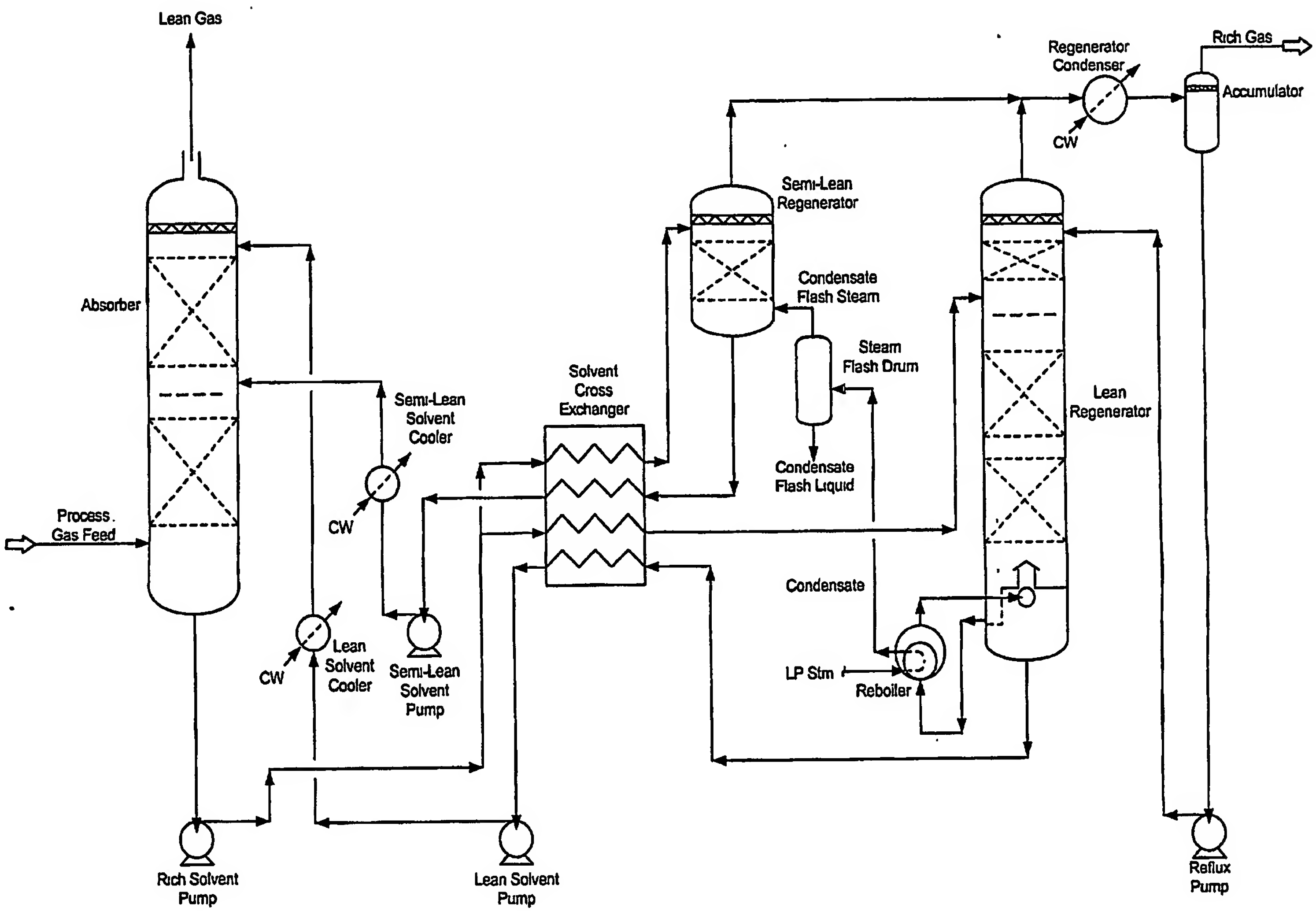
Lean Gas
Absorber
Process.
Gas Feed
Rich Solvent
Pump
CW
Lean
Solvent
Cooler
Semi-Lean
Solvent
Cooler
CW
Semi-Lean
Solvent
Pump
Lean Solvent
Pump
Solvent
Cross
Exchanger
Semi-Lean
Regenerator
Condensate
Flash Steam
Steam
Flash Drum
Condensate
Flash Liquid
Condensate
LP Stm
Reboiler
Lean
Regenerator
Regenerator
Condenser
CW
Rich Gas
Accumulator
Reflux
Pump

Figure 2

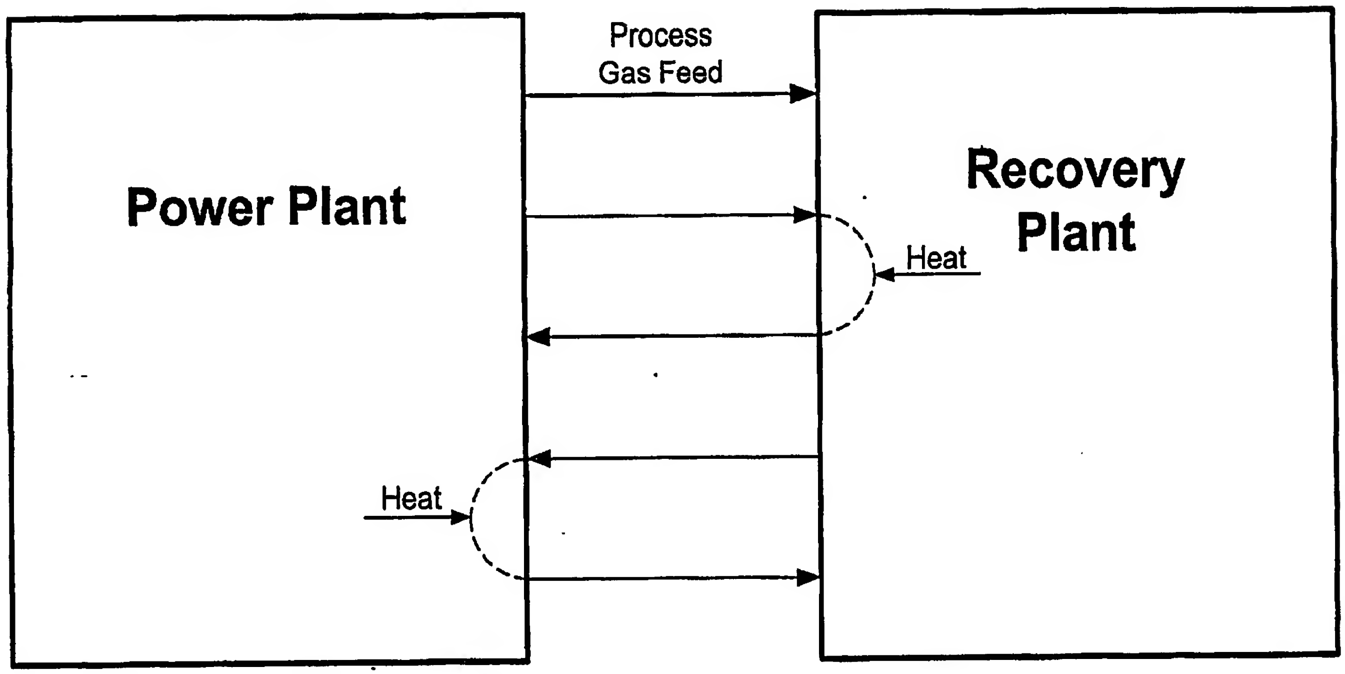

Figure 3